

(12) UK Patent Application (19) GB (11) 2 290 181 (13) A

(43) Date of A Publication 13.12.1995

(21) Application No 9510438.6

(22) Date of Filing 23.05.1995

(30) Priority Data

(31) 9411683 (32) 10.06.1994 (33) GB

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(51) INT CL<sup>5</sup>

H01H 71/26 77/08

(52) UK CL (Edition N )

H2K KHE K252 K254 K452 K453 K621

(56) Documents Cited

US 4876521 A

(58) Field of Search

UK CL (Edition N ) H2K KHE

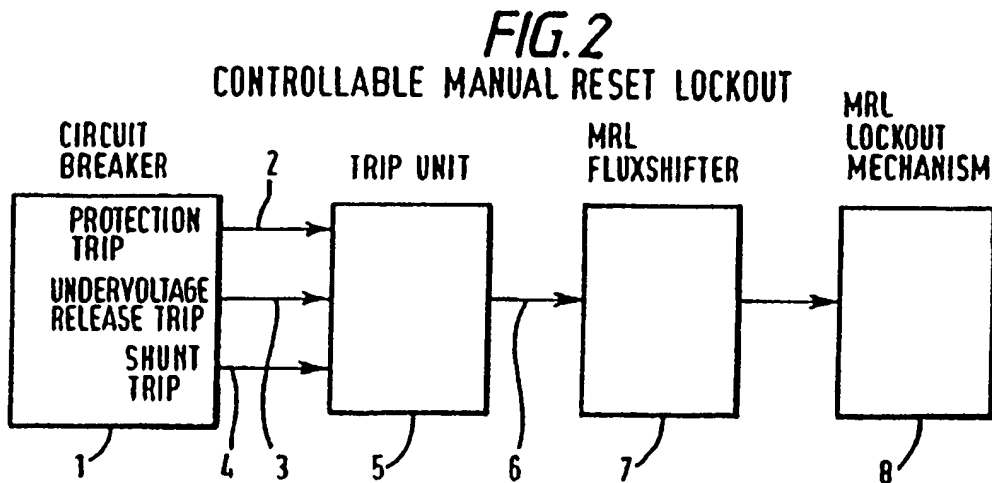
INT CL<sup>5</sup> H01H 71/10 71/12 71/14 71/16 71/24 71/26

71/32 71/66 71/68 77/08 77/10., H02H 3/06

Online : EDOC, JAPIO, WPI

(54) Circuit breaker lockout accessory

(57) A manual reset lockout accessory for a circuit breaker 1 is remote controlled and electronically selectable. The conditions that can cause the manual reset lockout to actuate are overcurrent protection-type trip 2, undervoltage release trip 3 or a shunt trip 4. The conditions that are selected are governed by switch settings in the trip unit 5. The coil of a flux shifter 7 is actuated by a transistor switch to prevent operation of the circuit breaker reset mechanism.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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FIG. 1

MANUAL RESET LOCKOUT PRIOR ART

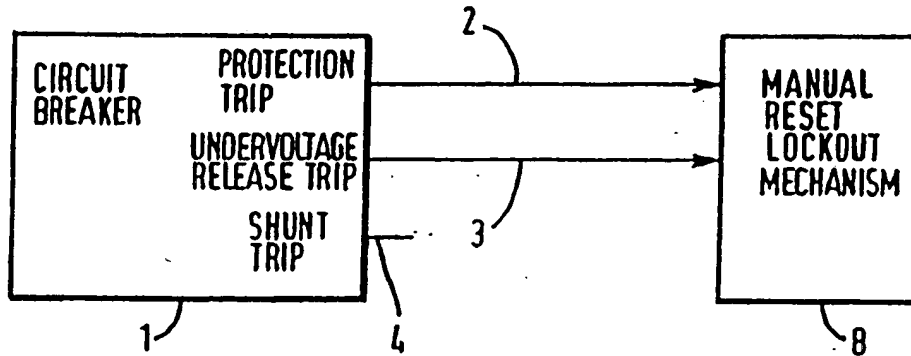


FIG. 2

CONTROLLABLE MANUAL RESET LOCKOUT

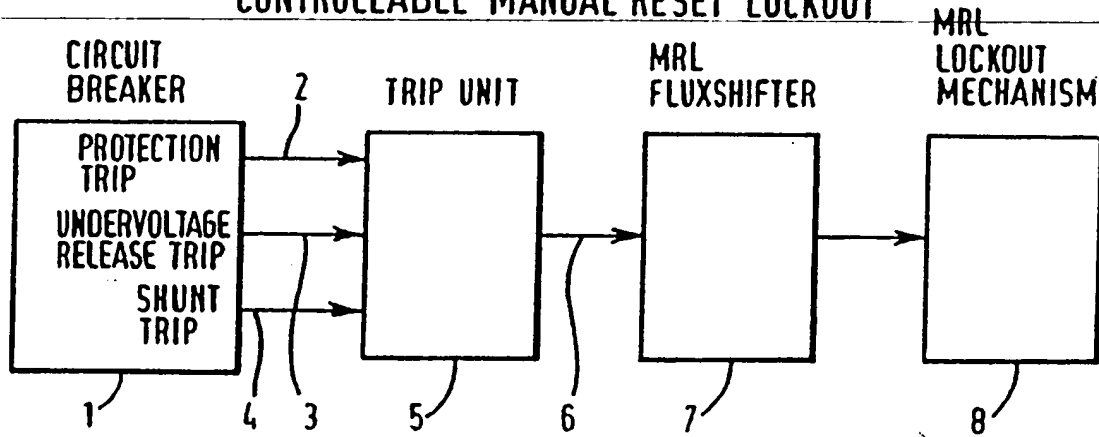
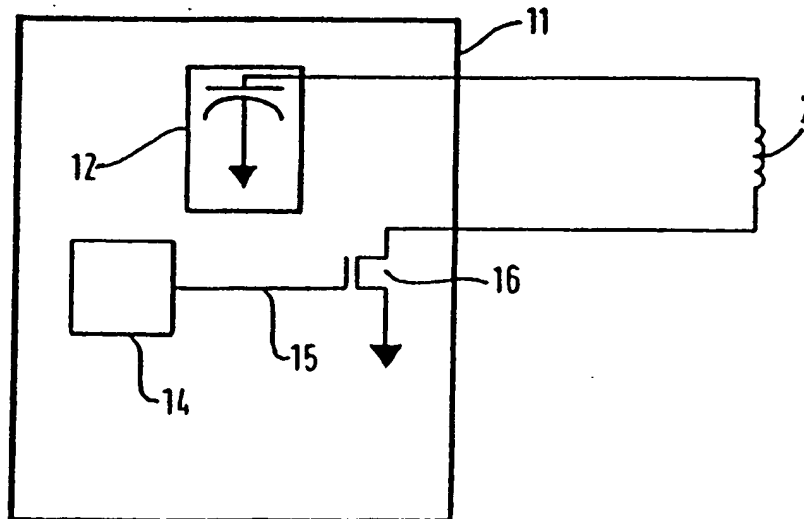


FIG. 3

MANUAL RESET LOCKOUT DRIVE CIRCUITRY



CIRCUIT BREAKER LOCKOUT ACCESSORY

An accessory function exists for a circuit breaker called Lockout which is normally part of another accessory such a Bell Alarm or UVR. In these cases this may require to versions of the host accessory such as a Bell Alarm with Lockout and a Bell Alarm without Lockout to exist. The lockout function when activated, serves to prevent breaker closure typically because a hazardous condition, such a breaker fault has occurred. It is typically activated when the breaker trips and activates an accessory with lockout such as the Bell Alarm with lockout. This function does not cease until the lockout is manually reset. This is typically achieved by pressing the trip button on the breaker.

Historically the lockout function is a purely mechanical linkage which is part of another accessory. Depending on how the lockout linkage and the accessory interface with the trip mechanism determines what trip conditions cause the lockout to actuate. This generally varies from breaker family to family. Some accessories do not have any lockout function as an option. Some accessories come with a mandatory lockout function such as some Bell Alarm accessories and this forces a manual reset with any event that actuates the Bell Alarm since it has the lockout. In some breaker families both options do exist but require the purchase of a separate accessory such as the UVR with lockout or the UVR without lockout as in the GE breaker family. The operation of prior art circuit breakers is, in this respect, determined by design, is fixed, and is not adjustable by the customer. The mechanical interface also requires calibration or adjustment as well.

Figure 1 shows the system level representation of the prior art. Item 1 is a circuit breaker with various mechanical outputs from its trip functions such as protection trip output 2, undervoltage release trip output 3 or shunt trip output 4. These outputs are historically

direct mechanical links to the manual reset lockout 5. As shown the shunt trip output 4 typically is not connected to the manual reset lockout 5.

5 According to a first aspect of the present invention, a circuit breaker lockout accessory comprises a flux shifter unit arranged for interfering with a reset mechanism in an associated circuit breaker to thereby prevent said reset mechanism from responding to reset the associated circuit breaker; and a set of switches  
10 connecting with a trip unit and said flux shifter unit allowing actuation of said flux shifter unit upon closure of any of said switches.

The circuit breaker lockout accessory may include a transistor switch connecting with a coil associated with  
15 said flux shifter unit, actuation of said transistor switch thereby energizing said coil and activating said flux shifter unit and may include means for providing energy to said flux shifter unit.

The transistor switch may comprise a FET and be  
20 arranged so that the trip unit connects with a gate on the FET for actuating the FET to energise the coil in accordance with the switches.

Preferably the coil is connected in series with the FET and the power supply which, for example, may comprise  
25 a capacitor.

Further preferably, the switch is connected with an overcurrent protection unit, and undervoltage release unit, or a shunt trip unit, or any combination of these.

30 According to a further aspect of the present invention a circuit breaker electronic trip unit having lockout accessory facility comprises a transistor switch connecting with a coil associated with a lockout flux shifter unit within an associated circuit breaker, actuation of said transistor switch thereby energizing said coil and  
35 activating said flux shifter unit to interfere with resetting the circuit breaker.

This circuit breaker electronic trip unit may also include the features of the embodiments described in

relation to the circuit breaker lockout accessory according to the first aspect of the present invention.

5 The present invention provides a new manual reset lockout which is remote controlled. Its operation is initiated by a dedicated flux shifter. This is the equivalent of a latching relay. This flux shifter is actuated by the trip unit and the operation can be selected due to a protection trip, undervoltage release, or a shunt trip or any combination of the above. The power for the trip unit may come from either the current transformers or control power if it is a protection trip, or the accessory power supplies if it is a undervoltage release or shunt trip.

15 Selection of what trip function causes the manual reset lockout to be selected is based on a set of switches in the trip unit. The options may include: 1) protection trip actuates manual reset lockout 2) undervoltage release actuates manual reset lockout 3) or shunt trip actuates manual reset lockout or any combination of the three.

20 With existing manual reset lockout accessories, installation requires that the breaker cover must be removed or it must be opened to mechanically connect the accessory to the trip mechanism. Sometimes mechanical adjustment is also required. This is rendered unnecessary and thus a time-consuming step and is not required by the present invention as it is electronically driven so obviating the need for a complex mechanical interface. This allows this accessory of the present invention to be a modular plug-in accessory and removes the need to route the wires through the breaker. It is also possible for the trip unit to cause a lockout according to other software driven functions or by a request sent over the communication network to the trip unit.

35 The manual reset lockout module may contain a target indicator which is raised out of the module when the accessory is actuated. This target can also serve as a reset button to reset the manual reset lockout. The manual reset lockout may have a pin that protrudes into the

breaker and interfaces with a lever that will prevent breaker closure when the manual reset lockout flux shifter has been actuated. When the manual reset lockout flux shifter has been reset it does not press against the lever and the breaker is not in a lockout state.

An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a schematic diagram of a manual reset lockout known in the prior art;

Figure 2 is a schematic diagram of a controllable manual reset lockout being an embodiment of the present invention; and

Figure 3 is a schematic diagram of the manual reset lockout drive circuitry of the embodiment of Figure 2.

The manual reset lockout accessory of the illustrated, exemplary, embodiment of the present invention is a plug-in module which is designed to plug into the breaker as described in British application number 9406942 entitled "MODULAR ACCESSORIES FOR CIRCUIT BREAKERS" (a copy of which is at Annex A). This facilitates installation or mounting of the accessory and provides electrical connection to the customer input and the trip unit.

The function of the proposed manual reset lockout is shown in Figure 2. The circuit breaker 1 has trip functions that can occur within the circuit breaker such as a protection trip 2, an undervoltage release 4, or a shunt trip 3. These signals are routed to the trip unit 5. Functions 4 and 3 are logic level signals. Function 2 is the result of analysing the signals from the current transformers in the breaker (not shown for clarity) for a trip condition.

Based on these inputs 2, 3 and 4 and the configuration of the trip unit 5, the trip unit decides whether it should actuate the manual reset lockout flux shifter 7 by applying current to its input leads 6. If the manual reset lockout flux shifter 7 is actuated, its mechanism 8 causes its plunger to interface with the breaker and cause breaker

lockout so that the breaker cannot be closed. The mechanism 8 is described in British application 9406946 entitled "MODULAR BELL ALARM AND LOCKOUT ACCESSORY" (a copy of which is at Annex B).

5           A limit switch could be included in the mechanism that indicates the position of the mechanism. In the reset position the switch would be in an unactuated state. When the flux shifter is actuated and actuates the mechanism the switch would change state. This additional switch could be  
10           used whether the manual reset lockout is used in the breaker or if it is employed outside the breaker as a remote device.

          Figure 3 shows the schematic representation of the circuitry involved in driving the manual reset lockout flux  
15           shifter of the embodiment of Figure 2. The trip unit 1 contains the necessary drive components. The power supply capacitor 2 is connected to the manual reset lockout. If the selection scheme 4 has decided to actuate the manual reset lockout flux shifter 7, it will drive the output 5  
20           high which is connected to the gate of the FET 6. This causes a current to flow through the manual reset lockout flux shifter 7 and actuates it.

**CLAIMS:**

1. A circuit breaker lockout accessory comprising:  
a flux shifter unit arranged for interfering with a  
5 reset mechanism in an associated circuit breaker to thereby  
prevent said reset mechanism from responding to reset the  
associated circuit breaker; and  
a set of switches connecting with a trip unit and said  
10 flux shifter unit allowing actuation of said flux shifter  
unit upon closure of any of said switches.
2. The circuit breaker lockout accessory of claim 1  
including a transistor switch connecting with a coil  
15 associated with said flux shifter unit, actuation of said  
transistor switch thereby energizing said coil and  
activating said flux shifter unit.
3. The circuit breaker lockout accessory of claim 2  
20 including means for providing energy to said flux shifter  
unit.
4. The circuit breaker lockout accessory of claim 2  
wherein said transistor switch comprises a FET.
- 25 5. The circuit breaker lockout accessory of claim 4  
wherein said trip unit connects with a gate on said FET for  
actuating said FET to energize said coil in accordance with  
said switches.
- 30 6. The circuit breaker lockout accessory of claim 5  
wherein said coil is connected in series with said FET and  
said power supply.
- 35 7. The circuit breaker lockout accessory of claim 6  
wherein said power supply comprises a capacitor.
8. The circuit breaker lockout accessory of claim 1  
wherein said switches connect with an overcurrent



protection unit, an undervoltage release unit or a shunt trip unit.

5 9. A circuit breaker electronic trip unit having  
lockout accessory facility comprising:

a transistor switch connecting with a coil associated  
with a lockout flux shifter unit within an associated  
circuit breaker, actuation of said transistor switch  
thereby energizing said coil and activating said flux  
10 shifter unit to interfere with resetting the circuit  
breaker.

15 10. The circuit breaker electronic trip unit having  
lockout accessory facility of claim 9 including means for  
providing energy to said flux shifter unit.

20 11. The circuit breaker electronic trip unit having  
lockout accessory facility of claim 10 wherein the said  
transistor switch comprises an FET.

12. The circuit breaker electronic trip unit having  
lockout accessory facility of claim 11 wherein said coil is  
connected in series with said FET.

25 13. The circuit breaker electronic trip unit having  
lockout accessory facility of claim 12 wherein said trip  
unit connects with a gate on said FET for actuating said  
FET to energize said coil in accordance with a set of  
externally accessible switches.

30 14. The circuit breaker electronic trip unit having  
lockout accessory facility of claim 10 wherein said power  
supply comprises a capacitor.

35 15. The circuit breaker electronic trip unit having  
lockout accessory facility of claim 13 wherein said  
switches connect with an overcurrent protection unit or an  
undervoltage release unit or a shunt trip unit.

16. A circuit breaker lockout accessory substantially as hereinbefore described with reference to Figures 2 and 3 of the accompanying drawings.

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<p><b>Patents Act 1977</b>  <b>Examiner's report to the Comptroller under Section 17</b>  <b>The Search report)</b></p>	<p><b>Application number</b>  <b>GB 9510438.6</b></p>
<p><b>Relevant Technical Fields</b></p> <p>(i) UK Cl (Ed.N)      H2K (KHE)</p> <p>(ii) Int Cl (Ed.6)      H01H (71/10, 71/12, 71/14, 71/16, 71/24,  71/26, 71/32, 71/66, 71/68, 77/08, 77/10)  H02H (3/06)</p> <p><b>Databases (see below)</b></p> <p>(i) UK Patent Office collections of GB, EP, WO and US patent specifications.</p> <p>(ii) ONLINE: EDOC, JAPIO, WPI</p>	<p><b>Search Examiner</b>  <b>D C BRUNT</b></p> <hr/> <p><b>Date of completion of Search</b>  <b>8 AUGUST 1995</b></p> <hr/> <p><b>Documents considered relevant following a search in respect of Claims :-</b>  <b>1 TO 16</b></p>

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Category	Identity of document and relevant passages	Relevant to claim(s)
A	US 4876521 (BOYD) whole document especially Figure 6	

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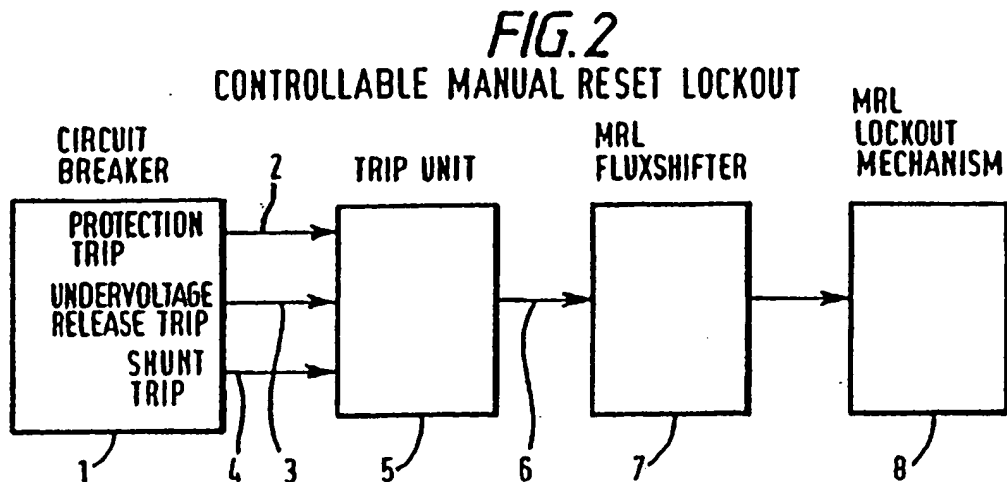
US 4876521 A

(58) Field of Search

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REGISTER ENTRY FOR GB2290181

Form 1 Application No GB9510438.6 filing date 23.05.1995.

Priority claimed:

10.06.1994 in United Kingdom - doc: 9411683

Title CIRCUIT BREAKER LOCKOUT ACCESSORY

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Classified to

H2K

H01H

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[ADP No. 06777882001]

Publication No GB2290181 dated 13.12.1995

Examination requested 29.05.1996

Grant of Patent (Notification under Section 18(4)) 03.11.1998

Publication of notice in the Official Journal (Patents) (Section 25(1))

02.12.1998

Title of Granted Patent CIRCUIT BREAKER LOCKOUT ACCESSORY

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RENEWALS DATA

Date Filed 23.05.1995

Date Not in Force

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